

Taxing Caloric Sweetened Beverages To Curb Obesity

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- High U.S. obesity rates have prompted calls for a tax on caloric sweetened beverages.
- Faced with such a tax, consumers are likely to substitute nontaxed beverages, such as bottled water, juice, and milk.
- A tax that increases the price of caloric sweetened beverages by 20 percent could cause an average reduction of 3.8 pounds of body weight over a year for adults and 4.5 pounds for children.

Obesity among the U.S. population has increased markedly over the past three decades. Two-thirds of U.S. adults are now either overweight or obese, and growing numbers of children are overweight as well. Studies by nutritionists and epidemiologists suggest that consuming beverages sweetened with sucrose (sugar) and/or high-fructose and other corn syrups is linked to risks for obesity and diabetes. Many public health advocates are calling for taxes on these caloric sweetened beverages as a way to reduce consumption and raise revenue for obesity-prevention programs.

ERS researchers analyzed the effects of a hypothetical tax on caloric sweetened soft drinks, fruit drinks, powdered mixes, and energy and sports drinks. The researchers found that a 20-percent tax on these beverages purchased at grocery stores and restaurants could trigger changes in consumption that would result in an average reduction of 37 calories a day for adults, which translates into a loss of 3.8 pounds of body weight over a year. The estimated decreases for children averaged 43 calories a day, or 4.5 pounds over a year.



Beverages Are a Major Source of Added Sugars

Americans, especially children, eat too much added sugar. Added sugars include cane and beet sugars, honey, molasses, and corn and other syrups used for home baking and sweetening, as well as sugars commonly added to processed foods and beverages, but not the naturally occurring sugars in fruit or milk. The 2005 *Dietary Guidelines for Americans* specify a “discretionary calorie allowance” for diets that include and do not exceed the recommended amounts of each food group. This allowance can be consumed via any food or beverage, including those with added sugars. The allowance is based on an individual’s energy (calorie) requirement, which, in turn, is determined by age, gender, body weight and height, physical activity level, and pregnancy/lactation status. For example, a man with a 2,400-calorie requirement and with a diet conforming to the *Guidelines* would have 362 discretionary calories, equivalent to roughly 23 teaspoons of added sugars. Likewise, a 4- to 8-year-old child on a 1,400-calorie diet conforming to the *Guidelines* would have 171 discretionary calories, equal to about 11 teaspoons of added sugars.

According to ERS calculations using the National Health and Nutrition Examination Survey (NHANES), during 1999-2004, American adults consumed an average of 21.6 teaspoons of added sugars a day and children (ages 2-19), 24.9 teaspoons a day. These amounts essentially exhaust the discretionary calorie allowance for a 2,400-calorie diet following the *Guidelines*, leaving no allowance for other foods. During the period, soft drinks and fruit drinks contributed 48 percent of added sugars to an average American child’s diet and 47 percent of added sugars for adults. Sugar, jams,

Caloric sweetened soft drinks and fruit drinks account for almost half of added sugars in the American diet

	Average consumption of added sugars from:							
Population	Soft drinks	Fruit drinks	Other drinks	Desserts	Ready-to-eat cereals	Sweets	Other foods	Total added sugars
	Teaspoons per day							
All	8.2	2.4	0.8	3.7	0.8	3.3	3.2	22.5
Children	8.4	3.6	0.6	3.6	1.5	3.9	3.4	24.9
Adults	8.1	2.0	0.9	3.7	0.6	3.1	3.1	21.6

Notes: Desserts include ice cream, custards, cakes, cookies, and other sweetened dairy foods and baked goods. Sweets include candies, jams, jellies, syrups, sugar, honey, and other sweeteners.

Source: USDA, Economic Research Service using the National Health and Nutrition Examination Survey, 1999-2004 and USDA, Agricultural Research Service’s Nutrient Data Laboratory.

candies, and other sweets accounted for 15 and 16 percent of added sugars in the diets of adults and children, respectively, and desserts accounted for 17 and 14 percent.

With a goal of reducing the role of calorie-dense, nutrient-poor foods in American children’s diets, the National Academy of Science’s Institute of Medicine recommended that local governments implement strategies to tax these foods and beverages to discourage consumption. The Institute of Medicine and other beverage tax advocates argue that the tax revenues generated could be used for campaigns to promote more healthful eating and to reduce or prevent obesity.

Soda Taxes Have Had Limited Impacts on Consumption

According to the not-for-profit group Bridging the Gap, 33 States levied sales taxes on regular and diet soft drinks purchased in grocery stores and other retailers in 2009, ranging from 1.2 to 7 percent, averaging 5.2 percent. Many States also implemented similar taxes on vending machine sales or levied excise taxes on manufacturers, distributors, or wholesalers based on the volume of drinks manufactured or sold.

Research indicates that current levels of taxation on soft drinks have had a relatively small impact on people’s weight and, in turn, their Body Mass Index (BMI). BMI

is a measure of a person’s weight adjusted for height and is used to distinguish weight status as healthy or unhealthy. A University of Illinois at Chicago study concluded that State-level tax rates on soda purchases of up to 7 percent over 10 years had no significant association with changes in adolescents’ BMI. Proponents of a tax on caloric sweetened beverages suggest relatively larger tax rates are necessary to substantially affect consumption. A 2009 article published in *The New England Journal of Medicine* proposes a 1-cent-per-ounce tax, which represents upward of a 50-percent-or-more increase in price depending on brand, container size, and on-sale occasions. For example, taxes for a 12-pack of 12-ounce cans of branded soda priced at \$6 would total \$1.44, or 24 percent, while taxes on a discounted 2-liter container of soda priced at \$1 would be \$0.68, or 68 percent.

Price Increase Would Lower Consumption

Taxing a product to reduce consumption hinges on the fundamental economic principle that people purchase less of a product when the price increases. The impact of a beverage tax depends, in part, on how much consumers curtail consumption in response to the higher beverage prices, a measure referred to as “own-price elasticity.”

Using grocery purchase data reported by a national household panel during 1998 to 2007, ERS researchers estimated a demand system that generated an own-price elasticity of -1.26 for caloric sweetened soft drinks, fruit drinks, powdered mixes, and energy and sports drinks. The ERS elasticity is similar to those reported in a 2009 review of food demand studies by researchers at Yale University's Rudd Center for Food Policy and Obesity. Given an own-price elasticity of -1.26, a 10-percent increase in price is predicted to reduce grocery store purchases of these caloric sweetened beverages by 12.6 percent (see box, "Elasticity Estimates Based on Grocery Store Purchases").

If a tax raises caloric sweetened beverage prices at stores and restaurants by 20 percent for consumers, then the average daily calorie intake from these beverages would fall by an estimated 38.8 calories for adults and 48.8 calories for children. However, this is not the end of the story.

Alternative Beverages Need To Be Considered, Too

Facing a higher tax-induced price, consumers would adjust their choices among alternative beverages, such as diet drinks, bottled water, juice, or milk—an adjustment referred to as “cross-price elasticity” by economists. Because juices and milk also provide calories, the failure to incorporate substitution of alternative beverages could bias assessments of the calorie-reduction effect of a beverage tax.

Past studies examining the reduction in beverage consumption resulting from a soft drink tax have used the own-price elasticity of soft drinks—typically both regular and diet—and largely ignored the cross-price effects. ERS researchers addressed this limitation by estimating a beverage demand system using eight beverage categories (caloric sweetened beverages, diet drinks, skim milk, low-fat milk, whole milk, 100-percent fruit/vegetable juices, coffee/tea, and bottled water) to determine the responsiveness of each category to the 20-percent tax on caloric sweetened beverages. Faced with a higher price for caloric sweetened drinks, consumers would purchase more bottled



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water, juice, and milk. Bottled water was found to have the strongest responsiveness to changes in the price of caloric sweetened beverages, while all three milk categories had the weakest. Diet drinks, juices, and coffee/tea had similar responsiveness, falling in between that of water and milk.

To calculate the net change in calorie consumption from shifting beverage choices, ERS researchers applied the estimated demand responses to beverage intake data from NHANES and used USDA's nutrient database to calculate the change in calorie consumption from alternative beverages. Led by increased consumption of calorie-containing juices and milk after the tax is imposed, average daily calorie intake from noncaloric sweetened beverages increased an estimated 1.9 calories for adults and 6.1 calories for children. Subtracting these calorie increases from the calorie savings from lower consumption of the taxed beverages results in a net decline of 36.9 calories per day for adults and 42.7 calories per day for children. But how does a decline in daily calorie intake translate into weight loss?

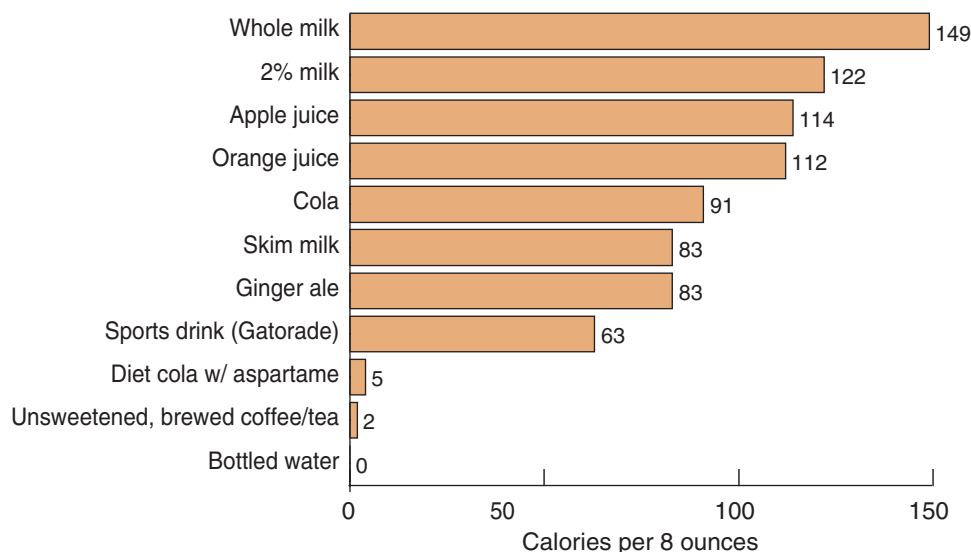
The relationship between calorie intake and body-weight change is complex, and a range of estimates has been reported in recent research. The commonly used relationship is that a reduction of 3,500 calories leads to a 1-pound loss in body weight. Using this relationship, and assuming all else is equal, such as constant physical activity and no shift to other calorie-containing foods,

Elasticity Estimates Based on Grocery Store Purchases

Due to data limitations, most estimates of beverage demand, including those by ERS, are based on grocery purchases. However, the large amount of beverages purchased in eating establishments, such as fast food and full-service restaurants, ball games, movie theaters, and other away-from-home locations, cannot be ignored. According to ERS analyses, about 50 percent of caloric sweetened beverages were consumed away from home during 2003-06.

Fast food and full-service restaurants often offer meal combos that include beverages. Likewise, some restaurants offer free beverage refills, which disconnects the relationship between quantity purchased and price. Because of these marketing conditions, consumers are likely to react differently to a price increase on foods in grocery stores than at other locations. While ERS acknowledges this possible disparity, in this study, at-home elasticities are applied to total at- and away-from-home consumption. This assumption also has been made, but not highlighted, in previous studies estimating the impact of a tax on beverage consumption.

Calorie content varies widely across beverages



Source: USDA, Agricultural Research Service's Nutrient Data Laboratory.

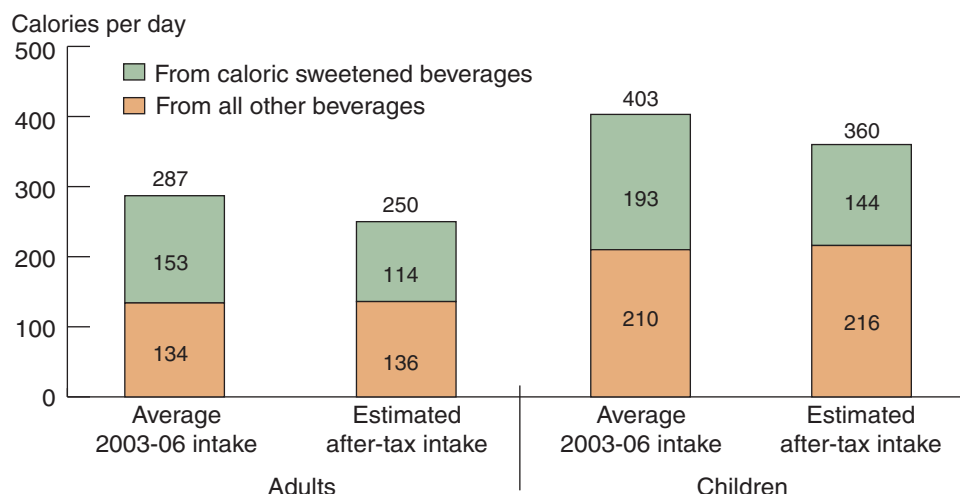
the daily calorie reductions calculated in the ERS study translate into an average loss of 3.8 pounds over a year for adults and 4.5 pounds over a year for children.

Based on calculations using NHANES data on individuals' beverage intake, body weight, and height, ERS predicts that, in response to a tax that raises prices of caloric sweetened beverages by 20 percent, the prevalence of overweight adults (BMI \geq 25) could decline from 66.9 to 62.4 percent; similarly, the prevalence of adult obesity (BMI \geq 30) could fall from 33.4 to 30.4 percent. Under the same scenario, the prevalence of children who are at risk of being overweight (at or above the 85th percentile of BMI-for-age) could decline from 32.3 to 27 percent, and the prevalence of children who are overweight (at or above the 95th percentile of BMI-for-age) could decline from 16.6 to 13.7 percent.

Two factors are responsible for the sizable estimated reductions in overweight and obesity. First, NHANES shows that a large group of adults and children are overweight and obese by only a few pounds, so small reductions in caloric intake would

improve their weight status. Second, many overweight adults and children consume large quantities of calories from sweetened beverages. For example, according to NHANES, 10.6 percent of overweight adults consumed more than 450 calories a day from caloric sweetened beverages in 2003-06, and 10.7 percent of obese adults consumed more than 450 calories a day

A 20-percent price increase from a tax on caloric sweetened beverages is estimated to reduce total calorie intake from beverages by 13 percent for adults and by 11 percent for children



Source: USDA, Economic Research Service using National Health and Nutrition Examination Survey data, 2003-06.



from these beverages. (The average U.S. adult consumed 152 calories per day from caloric sweetened beverages in 2003-06.) Some heavy drinkers of caloric sweetened beverages who curtail consumption of these drinks could lose enough weight to shift to a healthier weight status.

The tax would affect all those who consume caloric sweetened beverages—overweight, obese, and healthy weight individuals. ERS estimates of changes in overweight and obesity rates do not capture potential improvements in weight status among those with healthier weights. However, there are many individuals a few pounds shy of the BMI cutoffs for overweight and obese. Reduced consumption of caloric sweetened



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beverages triggered by the tax could prevent them from joining the ranks of the obese or overweight in the future. The tax-induced reduction in calorie intake could not only reduce obesity rates but also help certain borderline individuals from crossing the BMI obesity threshold.

Consumers Must Be Aware of the Tax

Economists are often tasked with calculating consumers' responsiveness to price signals. But for a consumer to respond to a higher or lower price, he or she must be aware of the price change. The ERS analysis assumed consumers were aware of the 20-percent tax on caloric sweetened beverages when making their beverage purchases. But would this be true in the marketplace?

A sales tax is applied as items are rung up at checkout, not displayed on the grocery store shelf. Consumers are often not aware of the tax burden or may not consider a sales tax when making food choices at grocery stores or restaurants, perhaps explaining, in part, past findings that BMI had no associations with State-level taxes. In addition, grocery purchases of beverages and other eligible foods using benefits from USDA's Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) are exempt from a sales tax. Thus, SNAP recipients would not be subject to the tax and the higher price.

Another way to tax caloric sweetened beverages is through an excise tax on drink manufacturers based on the quantity of sugar and syrups used in their products. If the tax is passed on to the retailers, who, in turn, incorporate it into a higher retail price, the increase in price would be displayed on the supermarket shelf or restaurant menu. Such a tax would more likely affect food choices than a sales tax, including the grocery purchases of those who receive SNAP benefits.

Reaction of Beverage Companies and Retailers Affects Impact of Tax

Manufacturers' and retailers' responses to taxes—both sales and excise taxes—affect the size of the tax paid by consumers. If the higher cost from an excise tax is not passed through to the consumer or partially absorbed by the manufacturer or retailer, the effect of the tax on beverage choices would be dampened. For example, manufacturers could decide to fully absorb an excise tax and not raise prices of the taxed beverages, or raise prices by less than the full tax rate. Similarly, retailers have the freedom to set shelf prices; they could lower prices to compensate for the sales tax. If only a portion of a tax is passed through to the consumer, a tax larger than 20 percent would be required to cause a 20-percent price increase.

Beverage manufacturers could also spread the cost of the excise tax across their products by raising prices of both taxed and nontaxed beverages, creating a situation where the relative price of caloric sweetened beverages versus alternative beverages would essentially remain unchanged. Under this scenario, consumers would be less likely to switch among beverages, again dampening the effect of the tax.

Using taxes or other disincentives to influence consumption is a complicated un-

dertaking with many unknowns. Modeling consumers' responsiveness to higher prices resulting from a tax on caloric sweetened beverages is just one step in predicting the impact of the tax. Responsiveness at the individual or household level could vary across other elements such as personal preference and income level. The ultimate outcome would depend on many factors, including the size of the tax, the type of tax, and the competitive strategies of beverage manufacturers and food retailers. **W**

This article is drawn from . . .

Taxing Caloric Sweetened Beverages: Potential Effects on Beverage Consumption, Calorie Intake, and Obesity, by Travis A. Smith, Biing-Hwan Lin, and Jonq-Ying Lee, ERR-100, USDA, Economic Research Service, July 2010, available at: www.ers.usda.gov/publications/err100/

You may also be interested in . . .

Fruit and Vegetable Consumption by Low-Income Americans: Would a Price Reduction Make a Difference? by Diansheng Dong and Biing-Hwan Lin, ERR-70, USDA, Economic Research Service, January 2009, available at: www.ers.usda.gov/publications/err70/
"The Price Is Right: Economics and the Rise in Obesity," by Jayachandran N. Variyam, in *Amber Waves*, Vol. 3, Issue 1, USDA, Economic Research Service, February 2005, available at: www.ers.usda.gov/amberwaves/february05/features/thepriceisright/htm

Taxing Snack Foods: What to Expect for Diet and Tax Revenues, by Fred Kuchler, Ababayehu Tegene, and J. Michael Harris, AIB-747-08, USDA, Economic Research Service, August 2004, available at: www.ers.usda.gov/publications/aib747/aib74708.pdf